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ATTRITION AMONG COLLEGE STUDENTS.

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TO INVESTIGATE STUDENTS' ABILITY TO COMPLETE FOUR YEARS OF COLLEGE WITHIN FOUR YEARS, 36,405 COLLEGE STUDENTS AT 246 INSTITUTIONS WERE POLLED BEFORE AND AFTER A FOUR YEAR INTERVAL. WHEN STUDENT CHARACTERISTICS WERE RELATED TO THEIR DROPOUT OR NONDROPOUT STATUS (DETERMINED BY THEIR SUCCESS IN COMPLETING FOUR YEARS WORK IN FOUR YEARS), IT WAS FOUND THAT DROPOUTS--(1) COME FROM LOWER SOCIOECONOMIC BACKGROUNDS, (2) DO NOT PLAN TO ATTEND GRADUATE SCHOOL, AND (3) HAVE LOWER GRADES IN HIGH SCHOOL. THE EFFECTS OF 36 CHARACTERISTICS ON DROPOUT RATES WERE ANALYZED. RESULTS INDICATE THAT 21 CHARACTERISTICS INVOLVING POSITIVE PEER RELATIONSHIPS, PARTICIPATION IN COLLEGE ACTIVITIES, FACULTY CONCERN FOR STUDENTS, AND CERTAIN ADMINISTRATIVE POLICIES ARE RELATED TO STUDENT PERSISTENCE IN COLLEGE. THE RESULTS SUPPORT THE BELIEF THAT EDUCATIONAL OUTCOMES ARE DETERMINED BY PERSONAL CHARACTERISTICS AND ENVIRONMENTAL EFFECTS. ALTHOUGH ENVIRONMENTAL EFFECTS ARE STATISTICALLY SIGNIFICANT, THEIR SUBSTANTIVE SIGNIFICANCE IS QUESTIONABLE. SUGGESTIONS FOR FUTURE RESEARCH ARE GIVEN. THIS ARTICLE IS ACE RESEARCH REPORT, VOLUME 2, NO. 4, 1967. IT WILL ALSO APPEAR IN A FORTHCOMING EDITION OF "THE AMERICAN EDUCATIONAL RESEARCH JOURNAL." (FR)

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American Council on Education

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Attrition Among College Students*

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* To appear in a forthcoming edition of the American Educational Research Journal.

Abstract

The ability to complete four years of college within four years after matriculation was examined in a longitudinal study of 36,405 college students entering 246 colleges and universities as freshmen in 1961. It was found that students who do not complete four years of college come from lower socioeconomic backgrounds, have lower grades in high school, and have a lower level of initial educational aspiration than do students who complete four years of college. An analysis of the effects of 36 college characteristics on student persistence in college was performed. After controlling statistically for differential student input to the various college environments, 21 significant college effects were observed. It was suggested that students are more likely to complete four years if they attend colleges where student peer relationships are characterized by friendliness, cooperativeness, and independence, where the students frequently participate in college activities, where there is a high level of personal involvement with and concern for the individual student, and where the administrative policies concerning student aggression are relatively permissive.

Attrition Among College Students

In the fall of 1961 a study of all entering freshmen students at a national sample of 248 colleges and universities was conducted at the National Merit Scholarship Corporation (Astin, 1965). The 127,212 students who participated in the study provided information on their socioeconomic backgrounds, high school activities and achievements, and educational and vocational aspirations.[1]

In the summer of 1965 the Office of Research of the American Council on Education[2] followed up randomly selected samples of students from each of the 246 colleges and universities included in the 1961 survey.[3] Questionnaires were mailed to 60,078 of the original 127,212 students -- or approximately 250 students per institution.[4] In this follow-up, data were obtained concerning the student's current educational and vocational plans and his experiences during the college years. In addition, a number of measures of the college environment were available from a follow-up questionnaire completed by 30,570 of the 60,078 students in the summer of 1962 (Astin, 1967).

The data obtained from this four-year longitudinal study have made it possible for us to examine how a variety of student characteristics are related to dropping out of college, and to estimate the impact of various features of the college environment on student persistence in college. This report presents the results of an analysis of the personal and environmental factors associated with dropping out of college.

For the purposes of our study, the student's criterion status (dropout or nondropout) was defined as follows: a <u>nondropout</u> was any

student who reported in 1965 that he had completed four or more academic years of college work, whether or not he had received a bachelor's level or equivalent degree. Thus, students who had changed colleges or had dropped out but re-enrolled and still managed to complete at least four years of college were defined as nondropouts. All other students, that is, students who left the institution they entered in the fall of 1961 and had not completed four years of college by the summer of 1965 were considered to be dropouts, even if they were enrolled in college at the time of the follow-up survey. This dichotomously scored criterion measure served as the dependent variable in the study. (Since some of the students classified as dropouts in this study will eventually graduate, and some of those classified as nondropouts will never receive a terminal degree, this study may be regarded as an analysis of the factors associated with completing four academic years of college work within the four years following matriculation.)

Method

The first step in the analysis of data obtained from this study was to relate the student's dichotomous criterion score ("dropout" or "nondropout") to the precollege input data that he originally provided in the fall of 1961. An "expected" criterion score based on the student's input data was thus computed, and a residual criterion performance score obtained by removing the effect of this expected score (that is, subtracting it) from his actual criterion score. The final step in the analysis was to relate the residual criterion score (now statistically independent of input) to the various environmental characterisitcs of the institutions attended by the students.

The statistical model used for computing the expected criterion score was that of linear multiple step-wise regression utilizing the com-

puting algorithm provided by Efromysen (1960). Intercorrelations were computed among the dependent variable and 120 independent (input) variables using a random sample of 3,821[5] subjects selected from the original sample of 36,405 students.[6] The .05 level was used as a cut-off for the step-wise procedure so that the resultant regression solution included those input variables whose independent contribution at each step to the reduction of the residual sums of squares was statistically significant at the .05 level of significance. The results of these analyses will be discussed later.

The justification for this somewhat elaborate analysis is two-fold. First, it enables us to exert some control over those personal characteristics of the student at the time of entering college that may determine much of his subsequent performance (Astin, 1963, 1964). Secondly, and more importantly, several recent empirical studies have demonstrated that it is possible for the apparent "effects" of an educational intervention (the college environment) and the student's criterion performance to be mediated simply by differential student input to various types of colleges and college environments (Astin, 1963, 1965; Astin and Holland, 1961). Therefore, we believe that it is essential that any analysis of the relationship between educational practice and student performance include an attempt to exercise control over differential student input. Otherwise, any relationships observed between environment and the criterion performance are, at best, ambiguous. While statistical controls of this type do not, of course, guarantee that the students entering different colleges have been equated on all relevant input variables (Astin, 1963), they serve to reduce the number of plausible rival interpretations of the findings (Campbell and Stanley, 1963).

A series of preliminary analyses of the data from this study were performed to determine the extent and potential effects of the bias in the sample of respondents. Although there were clearly biases in the mean scores on many items, these biases did not appear to have any appreciable effect on the relationships among the items. Since our primary concern is with cross-product relationships (that is, relative monotonic orderings among items), we have not attempted to adjust for these response biases in the computation of cross-products statistics. However, for descriptive summaries of the data involving marginal tabulations and simple bivariate cross tabulations, we computed a set of individual and institutional weights which were applied to the data in an attempt to estimate the population parameters of these descriptive summary statistics.[7] Thus, displayed in Tables 1 and 2 are some selected marginal tabulations of responses to questionnaire items that have been weighted so that, to the extent possible given our sample and pool of items, the data reflect the results that would have been obtained if (a) all students entering each institution in 1961 had completed our 1965 follow-up questionnaire (100 percent response rate), and (b) our sample of institutions was a simple random sample drawn from the defined population of regionally accredited four-year colleges and universities (Irwin, 1960).

Results

We estimate that 65 percent of the students in the population had completed four or more years of college at the time of the study (see Table 1). The dropout rate within the population, according to the definition we have given, was thus 35 percent. The correlation (phi) between sex and completing four or more years of college was not significant (r = -.002). Forty-four of the 120 student input variables in-

TABLE 1

Weighted[a] Marginal Tabulations of Responses to Selected Items

Item Description	Percents			
	Weighted N	Males	Weighted N	Females
Years of college completed:	356634		265779	
...Less than one term		1.9		2.3
...Less than one year		1.9		2.3
...One year		5.5		7.0
...Two years		9.3		9.3
...Three years		16.7		13.7
...Four or more years		64.7		65.4
Changed college or dropped out of college for any period of time since entering college of matriculation in 1961:	354994		264040	
...Yes		44.0		44.6
...No		56.0		55.4
Student left first college:	162519		120748	
...Because of unsatisfactory academic work		21.6		8.5
...Because of disciplinary reasons		3.7		2.5
...Voluntarily		74.7		89.0
Would have left first college even if I had greater financial resources:	130110		109419	
...Yes		57.9		66.0
...No		26.9		20.0
...Not Sure		15.2		14.0
Attended any other colleges since 1961:	163751		123236	
...Yes, (3 or more)		2.2		2.2
...Yes, (2 other)		12.5		13.4
...Yes, (one other)		47.4		48.9
...No		37.8		35.5

[a]Actual N = 30,506 (Males = 17,150; Females = 13,356). The sample size of 30,506 includes those subjects in the study who returned usable completed questionnaires to the Council's Office of Research; an additional 5,899 students provided only criterion information, but did not return the longer questionnaire. The weighting procedure for these marginal tabulations was applied only to the data obtained from those students who returned the longer form (Panos, 1967).

TABLE 2

Reasons Given for Leaving College of Matriculation in 1961

	Weighted Percents[a]					
	Males			Females		
Item Description	Weighted N	Major Reason	Minor[b] Reason	Weighted N	Major Reason	Minor[b] Reason
Changed career plans	113129	22.1	15.4	97379	20.7	13.6
Dissatisfied with college environment	114740	26.7	22.3	98366	27.0	19.7
Scholarship terminated	108070	2.8	3.1	93109	1.4	2.5
Wanted time to re-consider interests and goals	113791	26.4	22.4	95979	17.7	16.2
Marriage	108406	7.8	3.1	99319	29.0	6.1
Pregnancy	103942	1.1	0.6	93940	8.2	1.4
Tired of being a student	110522	11.3	16.3	94715	6.0	14.0
Could not afford cost	112639	23.6	15.6	97536	17.8	12.7
Academic record unsatisfactory	112942	15.5	20.8	95147	5.8	11.1
Drafted	107081	1.4	0.9	91881	0.0	0.1

[a]Actual N = 30,506 (Males = 17,150; Females = 13,356)

[b]A third alternative, "Unrelated to my decision," is not shown.

cluded in the analysis showed significant ($p = .05$) relationships to completing four or more years of college. However, only 20 of the 120 predictors were included in the final step-wise regression solution. Five of these 20 final predictors were not significantly ($p = .05$) related to the dependent variable in the zero-order correlation matrix. The results of the regression analysis are displayed in Table 3.

TABLE 3

Multiple Regression Analysis Showing Control of Input Variables on Dropout Criterion[a]

Step Number	Input Variable[b]	Mean[c]	Standard Deviation	b Coefficient	Multiple R	Partial R of Variable With[d] Residual Criterion	F Value Associated With Reduction in SS[e]
1	High school grade--C	1.062	.241	-.299	.153	-.153	91.18
2	High school grade--C+	1.104	.305	-.174	.191	-.116	52.36
3	High school grade--A	1.116	.320	.111	.215	.101	39.04
4	Career choice--secretary	1.007	.082	-.409	.231	-.087	29.16
5	Father's educ.--grad. degree	1.157	.364	.059	.244	.078	23.34
6	High school grade--B-	1.122	.323	-.105	.252	-.068	17.81
7	Plan professional degree	1.084	.277	.062	.259	.060	13.86
8	Married before college	1.008	.091	-.280	.265	-.058	13.13
9	Plan M.A. degree	1.252	.434	.054	.271	.056	12.22
10	Career choice--businessman	1.038	.191	-.146	.275	-.053	10.74
11	Race--white	1.970	.171	.238	.279	.049	9.19
12	H.S.--elected student office	1.466	.499	.052	.283	.048	9.16
13	Religious background--Jewish	1.054	.225	.085	.287	.047	8.69
14	Sex	1.436	.496	-.058	.290	-.045	7.88
15	H.S.--participated in plays	1.255	.436	-.048	.293	-.045	7.73
16	Career choice--engineer	1.068	.252	-.082	.297	-.044	7.88
17	Mother's education	3.594	1.241	.014	.299	.037	5.30
18	Race--Oriental	1.003	.051	.391	.301	.034	4.30
19	Race--Negro	1.015	.121	.183	.302	.035	4.70
20	High school grade--B	1.198	.399	-.039	.304	-.033	4.13

[a]The criterion was scored "1" if the student reported that in the four-year interval, 1961-1965, he had completed less than four years of college, and "2" if the student had completed four or more years of college.

[b]Only 20 of 120 student input variables entered into the step-wise regression analysis at the .05 level ($p = .05$).

[c]With the exception of mother's level of education, the entering input variables were scored dichotomously: 1 = no, 2 = yes. Mother's educational level was scored in six steps going from grammar school (scored 1) to graduate degree (scored 6); the six levels are: grammar school, some high school, high school graduate, some college, college graduate, and graduate degree.

[d]Partial correlation of entering variable at designated step number with residual criterion.

[e]Significant at or beyond the .05 level ($p = .05$), $N = 3,821$.

In brief, Table 3 shows that the entering college student who is most likely not to complete four years of college within the four years following his matriculation is one who had relatively low grades in high school, who does not plan at the time of college entrance to take graduate or professional work, who comes from a relatively low socio-economic background, and whose racial background is either American Indian or "other."[8] In addition, the dropout is relatively more likely than is the nondropout to have declared business, engineering, or secretarial work as his (or her) probable career occupation at the time of entrance to college. Finally, the dropout is more likely than is the nondropout to have been married when he started college.

In addition to such input variables as high school grades and socioeconomic background, this study included a number of variables that, to our knowledge, have not been reported in other studies. For example, the student's open-ended report of his father's occupation had been post-coded as being in one of 16 possible categories. Only two of these 16 dichotomously-scored variables showed significant ($p = .05$) zero-order correlations with dropping out, and none of them entered into the step-wise regression solution. Both father's and mother's educational levels, however, were predictive of completing four or more years of college. We had also coded the student's statement of his probable major field of study at the time of entering college into one of 15 categories, but none of these 15 dichotomous variables predicted whether or not a student would complete four or more years of college. However, three of the 30 dichotomous variables based on the students initial career choice did enter into the regression solution with significant weights (see Table 3). One other variable, size of high school class, was not predictive of the

criterion.

Rather than using an overall numerical index of the student's high school grade average, we defined nine levels of grade average (D, C, C+, B-, B, B+, A-, A, and A+), each of which was scored dichotomously. (Because of the very large sample size, it was possible to generate a number of such dummy variables in order to take advantage of all of the information contained in the original variables.) The results shown in Table 3 clearly indicate that high school grade average is monotonically related to completing four or more years of college. Assuming that this relationship is also linear, it would seem that little additional information is gained by scoring this continuous variable as nine separate vectors, at least for the analysis presented here.

It is also interesting to note that only two of 18 relatively high level secondary school achievements--election to a student office and participation in high school plays--entered into the step-wise solution. Finally, although sex was not significantly related to the dependent variable in the zero-order correlation matrix, being female was associated with dropping out in the final step-wise solution. This result is somewhat surprising since, as Summerskill (1962, p. 631) has pointed out, "Studies over the years...have either shown little sex difference in attrition rates...or somewhat less attrition among women at certain colleges." It appears that the largest adjustments in the partial correlation between sex and the criterion, prior to the entry of sex in the regression analysis, occurred after the entry of high school grades. Thus, when the relative advantage in college selection (as reflected in their higher grades) enjoyed by women has been controlled, we see that men are more likely to remain in college than are women. In short, these

data show that a woman is more likely to drop out of college than is a man who has a comparable high school grade average.

The results of the analysis of student input, as shown in Table 3, may be regarded as one more documentation of the fact that our ability to predict whether or not a student will drop out of college is clearly limited. Indeed, despite the relatively large number of input variables which were found to be related to completing four or more years of college (44 out of 120), the best (least squares) linear combination of input variables accounts for little more than nine percent of the variance in the criterion.

Differential College Effects

Table 4 shows the results of the analysis of the effects of college environmental factors on student attrition. Twenty-one of the 36 environmental measures[9] used in this study showed significant effects on the dependent variable after we had controlled the student input variables. That is, 21 of the 36 college variables were significantly ($p < .05$) associated with the dropout criterion, independently of those student characterisitcs that were assessed at the time of matriculation.

The environmental variables concerning student interpersonal relationships that are significantly related to the residual criterion are: Independence, Cohesiveness, Competitiveness vs. Cooperativeness, and Informal Dating (the last two are negatively related). These college measures indicate that students are more likely to complete four years if they attend a college where student peer relationships are characterized by Cohesiveness, Cooperativeness, and Independence. Students are more likely to drop out, on the other hand, if they attend colleges where there is relatively frequent Informal Dating among the stu-

TABLE 4

Environmental Variables Showing Significant Effects on Residual Criterion

Environmental Measure	Partial R of College Variable With Residual Criterion[a]
The Peer Environment	
(Interpersonal Behavior)	
Competitiveness vs. Cooperativeness	-.066
Independence	.064
Cohesiveness	.044
Informal Dating	-.033
(Noninterpersonal Behavior)	
Musical and artistic activity	.043
Use of automobiles	-.061
Use of the library	.048
Conflict with regulations	.040
The Classroom Environment	
Involvement in class	.047
Verbal aggression in class	.053
Severity of grading practices	-.055
Familiarity with instructor	.041
Amount of cheating	.071
The College Image	
Concern for individual student	.093
Faculty Permissiveness	-.035
Flexibility in required curriculum	-.033
Social activities	-.037
The Physical Environment	
Bigness	-.064
The Administrative Environment	
Policy against drinking	.044
Policy against aggression	-.045
Policy against cheating	.061

[a]Significant at or beyond the .05 level ($p = .05$), $N = 3,821$. The value shown is the partial R of the college environmental measure with the residual criterion after controlling for differential student input (see Table 3).

dents.

In the domain of student noninterpersonal behavior in the peer environment, four of 10 factors were significantly related to the resi-

dual criterion: Musical and Artistic Activity, Use of Automobiles (negatively), Use of the Library, and Conflict with Regulations. These measures indicate that dropping out is more likely in colleges where there is frequent use of automobiles by the students, and that it is less likely in colleges where the students frequently participate in musical and artistic activities, use the library, and--somewhat surprisingly--are in relatively frequent conflict with the regulations.

Five of our seven measures of the classroom environment were significantly related to the residual criterion. These patterns suggest that students are less likely to drop out if they attend colleges where the classroom environment is characterized by a high level of personal involvement on the part of the instructors and students, and where there is a high degree of familiarity with the instructor. Students are more likely to drop out if there is a relatively high rate of cheating in their college classes and if the grading practices are relatively severe.

Four of eight college variables having to do with the student's perceptions of the college (the college "image") were significantly related to the residual criterion. These measures suggest that those colleges that seem to foster dropping out are seen by the students as providing a good deal of opportunity for social activities, as allowing the student freedom in selecting his courses, and as having a permissive faculty. Colleges which encourage student persistence are seen as showing a good deal of Concern for the Individual Student.

The only college variable having to do with the physical environment, Bigness, shows a significant negative relationship to completing four or more years of college. This factor has to do mainly with the amount of time the student has to spend getting around the campus.

Three of the four measures concerning the administrative environment showed significant effects on student attrition. Severity of Administrative Policies Against Student Aggression is related to dropping out of college, whereas Severity of Administrative Policies Against Drinking and Against Cheating are positively related to completing four years of college.

The results of this study provide support for the notion that educational outcomes are determined both by the individual's personal characteristics and by the environmental context. Although the findings concerning environmental effects are statistically significant, their possible substantive significance is questionable because of the relatively small size of the coefficients. With these qualifications in mind, it may still be of use in planning future attrition studies to speculate on the possible meaning of these observed effects.

Our results suggest that at least two conceptually distinct, though perhaps related, patterns of environmental effects increase the student's chances of dropping out of college. The first pattern is concerned primarily with interpersonal relationships: a high level of student competitiveness and risk-taking, a good deal of informal dating, and limited opportunities for involvement with the college through familiarity with the instructors and other extracurricular activities that tend to bring the students and the college together.

The second pattern of environmental variables affecting attrition appears to involve influences that are administratively determined. In college environments with high rates of student attrition we find relatively severe grading practices, a faculty that is not concerned with the individual student, and considerable freedom granted the students in

their selection of courses. Although the administrative policies concerning both student drinking and student cheating are relatively permissive, the policy concerning student aggression is relatively severe. On the basis of this pattern one can speculate that those colleges that foster dropping out provide little or no structure for the individual student and show a relative lack of concern for his progress or conduct, except when his conduct directly threatens the operations of the institution (that is, aggression).

It is of some interest that the environmental effects observed in these analyses were not more pronounced, since the sample of 246 institutions was extremely diverse in terms of environmental characteristics (Astin, 1967). These findings suggest that the large known differences among institutions in attrition rates are a function more of differences in their entering students than of differences in measurable characteristics of their environments.

The results of the multiple regression analysis document once again our inability to predict accurately whether or not a given student will drop out of college. A possible explanation for this result is that we failed to include other important input variables. For example, it is possible that more information about the student's academic ability would have improved the prediction. Or, perhaps, our information about the student's attitudes, values, and other personality traits was inadequate. A second possible interpretation is that the criterion, as defined, is too heterogeneous. Finally, it may be that a different type of analysis involving, for example, a variety of possible interaction effects among the variables studied would substantially improve our prediction.

In view of the fact that this research deals with a national

sample of college students and a relatively large pool of diverse input items, it seems unlikely that the introduction of additional input controls of the type used here would result in dramatic improvement in prediction. In any event, this research strongly suggests that future attrition studies include both input and environmental variables.

The need for an unambigious (even though necessarily arbitrary) definition of the dropout can be illustrated by some of the results from this study. For example, although 65 percent of the population had completed four or more years of college, only 50 percent of the men and 62 percent of the women had received a bachelor level degree at the time of the study. Obviously, if a researcher chose to define as a dropout any student who did not achieve a bachelor's level degree within four years of matriculation, his "dropout" study would deal with a somewhat different phenomenon than does ours. Again, estimates of the percentage of students who do not return to their college of matriculation after the freshman year vary from as low as four percent to as high as 51 percent, depending on the reporting agency.[10] However, as can be seen from Table 1, after four years only four percent of the population had actually completed less than one year of college. Table 1 also shows that although slightly more than 44 percent of the students indicated that they had changed college or dropped out of college since 1961, 63 percent of these students had also attended at least one other college since 1961.

The purpose of the preceding discussion is twofold. First, we want to emphasize the equivocal nature of the term "dropout." It is important to note that the results of many attrition studies are not comparable because they in fact deal with different phenomena. Secondly, we wish to take issue with the currently modish trend in the field to

criticize research on dropouts that "...fails to distinguish between a student's withdrawal on a temporary basis and his permanent loss to higher education" (Boyer and Michael, 1965, p. 279). Research which attempts to establish the student's "permanent loss to higher education" must wait for its completion until all the subjects in the study have either completed their education or died. The point is simply that it is important in any research on dropouts that "dropout" be unambiguously defined, and that the definition make sense with regard to the problem being investigated and to the possible applications of the findings.

With regard to the heterogeneous nature of the dropout criterion, we feel that the kinds of analyses presented in the present study should be repeated in studies where the students are further classified as to their reasons for dropping out. By comparing such relatively homogeneous criterion-status subsamples it may be possible to improve our predictive accuracy and thereby to shed more light on the attrition process. Further analyses of this type are currently underway.

Footnotes

[1]This study was supported in part by Grant G-13704 from the National Science Foundation.

[2]The follow-up study is supported in part by Grant GS-22 from the National Science Foundation, the U.S. Office of Education, and the National Institutes of Health under a transfer of funds agreement.

[3]This sample of 246 institutions had originally been selected to be representative of the total population of regionally accredited four-year colleges and universities as of 1961. The sampling design employed was a

modified stratified random sample design (See Astin, 1965, pp. 103-105).

[4]For institutions enrolling fewer than 300 freshmen in 1961, all students were included; random samples of 250 students were selected from the larger institutions. The arbitrary figure of 250 students was chosen with the expectation that we would obtain about a 50 percent rate of return. The final number of usable completed forms returned was 36,405--slightly more than 60 percent of the original 60,078 students. However, because of out-of-date addresses from which the U.S. Post Office could not forward the questionnaire, we estimate that between 75 percent and 80 percent of the students who received questionnaires eventually returned them.

[5]This relatively large sample size was selected in order to ensure a high degree of stability in the regression weights. The independent variables include basic biographic and demographic variables such as race, religion, sex, parental income, parents' level of education, father's occupation, and other background information such as size of high school class, high school grades, high school achievements, initial major field of study, initial career choice, and initial level of educational aspiration. Many of these variables were scored as dichotomous "dummy" variables.

[6]Note that the expected criterion score (a weighted linear regression composite) and, hence, the residual criterion score are both continuous variables, whereas the actual criterion score can assume only one of two values. Although it would have been possible to perform a multiple discriminant analysis instead of the multiple point-biserial regression analysis that was used, the two methods yield sets of weights that are proportional (Michael and Perry, 1956). Since we controlled for the effects of student input variables before observing the effects of college environmental variables, our regression analysis is similar to the "reduced

model" as described by Bottenberg and Ward (1963).

[7]The biasing variables significantly ($p = .05$) related to whether or not the student returned a questionnaire were: initial level of educational aspiration; whether or not the student had ever published an original work; high school grade average; and father's educational level, (Panos, 1967).

[8]The students indicated their racial background as either Caucasian, Negro, Oriental, American Indian, or "Other." Because of arbitrary limits on the number of input variables in our regression analysis program, we were unable to include the dichotomously-scored alternatives "American Indian" and "Other" in the analyses. Since the other three race variables entered into the step-wise solution with positive weights (see Table 3), at least one of the remaining race variables is negatively related to the criterion.

[9]A pool of over 250 items covering five broad categories (the peer environment, the classroom environment, the college image, the administrative environment, and the physical environment) was analyzed to define the relatively independent environmental dimensions (Astin, 1966, 1967). Mean scores on each of the items were computed separately for each of the 246 institutions and used as input to a series of factor analyses using the institution as the sampling unit. This procedure led to the definition of 36 environmental factors. Scores for each institution on each factor were computed using step-wise multiple regression analysis in which the factor loadings of the items were used as the criterion correlation (Astin, 1967).

[10]These figures are taken from a longitudinal study currently in progress of the entering 1965 freshman classes at 61 colleges and universities. The study is being conducted by the Office of Research, American Council on Education (Astin and Panos, 1966; Astin, Panos, and Creager, 1966; 1967).

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